REMARKS

Claims 1-6, 8-23, 49-55 and 58-59 are currently pending in the application. Claims 7, 24-48, 56, and 57 have been cancelled. claim 58 is a new independent claim and is similar to claim 1. Claim 59 depends from claim 58. No new matter has been added.

Consideration of Exhibits in Prior Response

The Examiner does not indicate in the present Office Action whether the Petition filed under 37 CFR §1.91(a)(3) on July 28, 2008 for entry of a compact disc has been granted and the Exhibits (one audio file and two video files) contained on the compact disc have been entered in the application and considered prior to issuance of the present Office Action. These files are relevant to the prior and current rejections since they directly address the nonobviousness of the claimed invention and provide factual support for the patentability of the present invention over the prior art. Applicants request formal indication of entry and consideration of the evidence in this application.

Arguments

Claims 1, 3, 5 and 8-17 have been rejected under 35 U.S.C. 103(a) as being unpatentable over US Patent No. 5,910,688 (Li) in view of US Patent No. 4,132,499 (Igra). The Examiner has cited Li as teaching a roof mountable turbine with a rotor, plurality of blades and a ring-shaped diffuser that connects to the outer tips of the blades, and that the diffuser is shaped to inhibit partly axial and partly radial airflow. The Examiner correctly noted that Li does not teach an aerofoil diffuser. The Examiner has, however, cited Igra as disclosing an aerofoil shaped diffuser, and has taken the position that it would have been obvious to add the aerofoil shaped diffuser of Igra to the windmill of Li in order to increase power output of the turbine. Claims 2, 4, 6 and 7 were rejected as being unpatentable over the combination of Li and Igra in view of U.S. Patent No. 5,599,172 (McCabe). Claims 49- 52 were rejected as being unpatentable over the combination of Li and Igra in view of U.S. Patent No. 5,669,758 (Williamson). Claims 53-57 were rejected as being unpatentable over the combination of Li, Igra, Williamson

and U.S. Patent No. 4,377,812 (Gobel et al.) Applicants respectfully disagree with the current rejections.

One of the key benefits of the present invention is the arrangement of the ring-shaped aerofoil diffuser and its connection to the outer tips of the blades. This combination influences the airflow leaving the rotor in a way which yields vastly superior acoustic characteristics (i.e. <35dBA noise emissions across all wind speeds.) Detailed evidence was provided in the response to the prior Office Action, including an audio file and video files, which all support the nonobviousness of the present invention.

The Examiner argues in the Office Action that *"Li clearly teaches the construction of a 'roof mountable' windmill."* Applicants disagree. The wind turbine of Li is supported on a tall tower (22) that positions the turbine "at an elevated location so that [it] can function smoothly without being affected by the turbulent flow rising from the ground surface" (see, Li, Column 2, lines 20-24). Such a location results in the turbine experiencing a completely different form of airflow than a roof-mounted windmill. The claimed invention is directed to a turbine that is specifically adapted to cope with turbulent airflows inherent in small scale roof mounted turbines. Thus, it is respectfully submitted that Li's turbine is <u>not</u> intended for roof-mounting in built up areas where turbulent airflow is inevitable. As such, a person of ordinary skill in the art would not consider the disclosure of Li when attempting to design a roof-mountable wind turbine.

The Examiner goes on to state that Li discloses "*a rotor* (1) *having a plurality of radial blades* (11) *and a ring-shaped diffuser (10) connecting the outer tips of the blades.*" However, Applicants wish to point out that the outer ring (10) in Li is not a diffuser. It is well established in the art of wind turbines that a diffuser is defined in relation to its positioning downstream of the rotor plane. In support of this Applicants have attached as Exhibit A illustrations (see third and fourth drawings on the bottom row) from a standard wind energy reference text titled: <u>Wind Energy Explained Theory, Design & Application</u> by J.F. Manwell, J.G. McGowan & A.L. Rogers, John Wiley &

Sons Ltd. (2002). Exhibit B includes a copy of the definition of "diffuser' from Webster's Ninth Collegiate Dictionary, Merriam-Webster (1983) which defines a diffuser as "a device (such as slats at different angles) for deflecting air from an outlet in various directions." (Emphasis added) Thus, a person skilled in the art would understand that a diffuser in a windmill device is a structure located *downstream* from the rotor plane.

As can be clearly seen from the drawings in Li (particularly Figs. 2b and 3), the outer ring (10) is mounted at a location that is forward of the rotor plane so as to act as a concentrator or funnel to increase airflow through the blades. This is the very antithesis of a "diffuser". Support for this view is provided by the reference to a *"dish-like profile"* defined by the outer ring (10) and the hub (14) in Fig. 2b (see, column 2, line 34) and references to a "funnel (23)" and *"improved wind capturing efficiency* "of the arrangement of Fig. 3 (see col. 2, lines 55-63). The term "capturing" as used in Li says it all, the structure is designed to capture air, not diffuse it. Therefore, contrary to the Examiner's position, it is submitted that a person of ordinary skill in the art would not understand Li as disclosing a rotor having a ring-shaped diffuser connecting the outer tips of the blades.

In view of the above, the Examiner's next statement is also incorrect. In particular, the outer ring (10) disclosed in Li is absolutely not "*shaped such that it inhibits the partly axial and partly radial airflow from the blades.*" In reality, the outer ring (10) in Li cannot inhibit the airflow from the blades because it is located upstream from the outer tips of the blades in the manner of a concentrator (or funnel as described in Li) and not downstream in the manner of a diffuser. The outer ring (10), therefore, does not influence the airflow to move circumferentially in view of the absence of a diffuser extending in the downstream direction from the blade tips.

It follows from the above discussion that the arrangement of Li will **not** result in a reduction of acoustic emissions because the absence of a diffuser adjoined radially and downstream of the blades means that the airflow reaching the blade tips would simply be

shed suddenly and violently without being inhibited in either the axial or radial directions as is required by claim 1.

As was summarized in the response to the previous Office Action (see "Summary of Present Invention" on pages 8-10), a considerable noise is emitted when airflow leaves a conventional rotor's blade tips (known in the art as 'vortex shedding') and the sound heard is often likened to a loud "ripping" noise. This unwanted noise is produced because the radial airflow travelling along the blades' surfaces suddenly detaches from the blade tips and moves rapidly downstream in the form of noisy turbulent airflow. Conventional windmill designs attempt to reduce acoustic emissions by optimizing the shape and/or surface qualities of rotor blades. Applicants approached the problem from an entirely new angle which has resulted in genuinely surprising and very effective results as will be discussed below.

In summary, the Examiner's position that the sole difference between claim 1 and the disclosure of Li lies in Li's failure to disclose an aerofoil-shaped diffuser is not correct. In fact, as discussed above, Li actually fails to disclose a diffuser *per se*. This important structural difference also means that the resultant functional features of claim 1 cannot occur in Li's windmill.

Additionally, Applicants disagree on the teachings that the Examiner reads from Igra. Igra relates to a wind turbine having a fixed aerofoil-shaped shroud (10) surrounding, but spaced from, the blades (6).

The Examiner argues that this document discloses a rotor having an aerofoil diffuser "*shaped such that it inhibits the partly axial and partly radial airflow from the blades.*" In fact, the arrangement of air channels (20, 26, 28) in the Igra diffuser actually serves to promote axial airflow from the blades by "*injecting a flow of air of high kinetic energy from the airstream external of the shroud to the boundary layer of the airstream within the diffuser*" (see paragraph bridging columns 2 and 3). The use of such air intake channels downstream from a turbine blade is a well known and commonly used in such

airfoils to draw air into the contained airflow. It is, therefore, clear from this passage of text that the air leaving the blade tips is prevented from reaching the inner surface of the diffuser by the presence of the "external" air introduced through the outlets (28).

The Examiner goes on to state that the airflow becomes "*circumferential when it contacts the aerofoil diffuser, thereby reducing acoustic emissions, for the purpose of increasing the power output of the turbine.*" However, the examiner's statement is not correct. Notwithstanding the fact that the airflow leaving the blade tips is contained by the boundary layer referred to above, since the shroud (10) is fixed, it simply cannot impart any additional circumferential component of motion to the airflow leaving the blade tips. Therefore, the specific change in airflow direction recited in claim 1 of the present invention, which is due to the specifically claimed structure, does not occur.

More importantly, the absence of any adjoining surface radially from the blade tips means that there is nothing to prevent airflow detaching suddenly from the blades and creating the noise problems discussed above, and described in detail in our previous response.

Furthermore, the Examiner's reference to "*increasing the power output of the turbine*" suggests a misunderstanding of the purpose of the present invention despite the detailed explanation in the previous response that the problem being solved is that of drastically reducing unwanted acoustic emissions. Interestingly, the very passage referred to by the Examiner (column 1, lines 20-21) goes on to state that the diffuser section of the shroud must be of a "*long length,*" a requirement which is specifically avoided in the diffuser ring of the present invention.

The Examiner goes on to conclude that it would have been obvious at the time the invention was made to incorporate the aerofoil shape of the diffuser disclosed by Igra on the windmill disclosed by Li for the purpose of increasing the power output of the turbine. Once again, we would reiterate that the Examiner has overlooked the purpose of Applicants' invention which is focused solely on drastically reducing acoustic emissions

as opposed to increasing power output. Based on the foregoing, we would respectfully submit that a person of ordinary skill in the art would have no reasonable expectation that the combination of features found in Li and in Igra might provide a solution to acoustic emission problems.

In *KSR International, Co v Teleflex, Inc.* (2007), the Supreme Court noted that a rejection based on a combination of prior art documents is not proper if:

(a) one of ordinary skill in the art could not have combined the claimed elements by known methods;

(b) the elements in combination do not perform the function that each of the elements perform separately or as claimed; or

(c) the results of the claimed combination were unexpected.

It is respectfully submitted that all three of the above tests are satisfied.

The Examiner has taken the position that merely replacing the outer ring of Li with the shroud of Igra would yield predictable results in terms of increased power output. However, it is submitted that one of ordinary skill in the art could not attach the shroud of Igra to the blade tips of Li by known methods. In particular, the elongate size and shape of Igra's shroud makes its use technically impractical for smaller scale roof-mountable turbines that must necessarily be lightweight and mobile. For example, the shroud (10) in Igra is much larger that the blades in Li and is supported on a central body (4) by stator blades (14) and braces (50,52). Putting aside the fact that the likely technical difficulties a person skilled in the art would encounter to connect Li's blades (11) to the shroud (10), it is unlikely that the blades (11) would be capable of bearing the shroud's weight. Even if they could, the increased overall weight of the rotor would inevitably cause a decrease in rotational speed and, thus, actually reduce its overall power output.

In any event, as stated above, producing increased power output is not something the present invention tries to achieve. Furthermore, it is well accepted in the art that it is highly undesirable to have a large mass, such as the shroud of Igra, rotating at the outer

extremity of relatively light weight blades, such as those disclosed in Li. Accordingly, test (a) above is satisfied.

The Examiner appears to be of the mistaken belief that the respective shapes of Li's outer ring and Igra's shroud each cause a reduction in acoustic emissions and, therefore, seems to believe that the simple substitution of Igra's shroud for Li's outer ring will yield predictable results. However, it is submitted that this is not the case. In particular, the features of Li and Igra in combination would not perform the recited noise reduction of the claims since, as discussed above, both turbines will inevitably produce significant acoustic emissions. This is completely contrary to the intended purpose and recited features of the claim. Accordingly, test (b) above is satisfied.

With regard to test (c), the inventors themselves have confirmed that the results of their original investigations in terms of the degree of reduction of acoustic emissions was entirely surprising and unexpected. This was discussed extensively in the prior response and documented in the evidence submitted with the response. It is notable that competing wind turbine designs have failed to achieve comparable acoustic performance even though the need for quiet operation is well understood to be a desirable feature. As discussed above, such competing designs have tended to concentrate on blade design in terms of its surface qualities and tip shape in an effort to reduce sound emissions but none have achieved the degree of improvement provided by the present invention.

Accordingly, the above comments clearly establish that the features recited in claim 1 were not obvious. Applicants note the Examiner's indication that the use of the word "mountable" in claim 1 is not a positive limitation in any patentable sense, but only requires the ability to so perform. Applicants' note that the term does impose a structural limitation on the claim in that the construction of the device must be capable of being mounted on a roof, which the cited references are not. Thus, that term limits the weight and configuration of the various components. For example, as discussed above, the Igra diffuser could not possibly be mounted on the blades in Li and be mountable to a roof. In

any event, the claim has been modified to clearly denote that the rotor is for a roof-mounted wind turbine, thus more specifically defining the invention.

As discussed above, the structural arrangement recited in claim 1 provides a surprising reduction in acoustic emissions. The specific shape of the aerofoil can be adjusted depending on several variables such as the diameter of the diffuser and the typical wind conditions it will be exposed to.

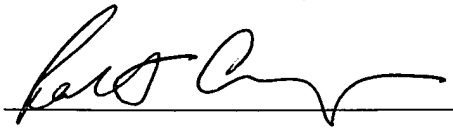
Based on the foregoing, it is respectfully submitted that the present invention as recited in claim 1 is patentable over the combination of Li and Igra. All the other pending claims depend from claim 1 and are, therefore, also patentable over the combination of Li, Igra and any other references of record. As such, Applicants respectfully request reconsideration and withdrawal of the rejection in the application.

New claim 58 is similar to claim 1. All of the arguments discussed above with respect to claim 1 apply equally to claim 58. Accordingly claim 58 and dependent claim 59 are patentable over the prior art of record.

If the Examiner believes direct communication with Applicants' attorney will expedite examination of this case, he is invited to call the undersigned.

Respectfully submitted,

David Ewart Anderson, et al.

BY: 

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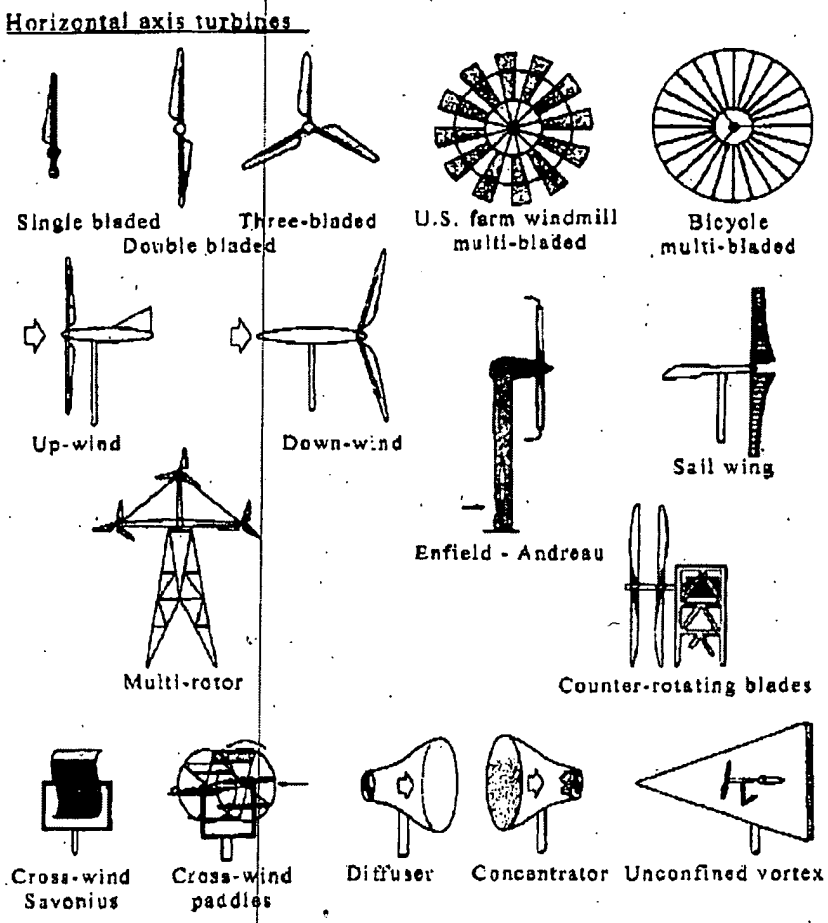

Figure 1.5 Various concepts for horizontal axis turbines (Eldridge, 1980)

R'S

Ninth New Collegiate Dictionary

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die-sel-ing \'dēz-(ə-)liŋ, 'dēs-\ *n* (ca. 1955) : the continued operation of an internal-combustion engine after the ignition is turned off

die-sel-ize \'dē-zə-ˌlīz, 'dē-sə-\ *vt* **-ized; -iz-ing** (1925) : to equip with a diesel engine or with electric locomotives having electric generators powered by diesel engines — **die-sel-iza-tion** \ˌdē-zə-lə-'zā-shən, ˌdē-sə-\ *n*

die-sink-er \'dī-ˌsiŋ-kər\ *n* (1815) : one that makes cutting and shaping dies — **die-sink-ing** *n*

Di-es Irae \ˌdē-(ˌ)ā-'sē-ˌrā\ *n* [ML, day of wrath; fr. the first words of the hymn] (ca. 1805) : a medieval Latin hymn on the Day of Judgment sung in requiem masses

di-esis \'dī-ə-səs\ *n, pl* **di-eses** \-ˌsēz\ [NL, sharp (in music), fr. L, quarter tone, small interval, fr. Gk, fr. *diiēnai* to send through, fr. *dia-* + *hienai* to send — more at JET] (ca. 1706) : DOUBLE DAGGER

di-es-ter \'dī-ˌes-tər\ *n* (1935) : a compound containing two ester groupings

die-stock \'dī-ˌstäk\ *n* (1863) : a stock to hold dies used for cutting threads

di-es-trus \(ˌ)dī-'es-trəs\ *n* [NL, period of sexual quiescence, fr. *dia-* + *estrus*] (1942) : a period of sexual quiescence that intervenes between two periods of estrus — **di-es-trous** \-trəs\ *also* **di-es-tru-al** \-trə-wəl\ *adj*

[1]di-et \'dī-ət\ *n* [ME *diete*, fr. OF, fr. L *diaeta* prescribed diet, fr. Gk *diaita*, lit., manner of living, fr. *dia-* + *-aita* (akin to Gk *aisa* share)] (13c) **1 a** : food and drink regularly provided or consumed **b** : habitual nourishment **c** : the kind and amount of food prescribed for a person or animal for a special reason **2** : something provided esp. habitually (as for use or enjoyment) ⟨a ~ of Broadway shows and nightclubs —Frederick Wyatt⟩

[2]diet *vt* (14c) **1** : to cause to take food : FEED **2** : to cause to eat and drink sparingly or according to prescribed rules ~ *vi* : to eat sparingly or according to prescribed rules — **di-et-er** *n*

[3]diet *n* [ML *dieta*, day's journey, assembly, fr. L *dies* day — more at DEITY] (15c) **1** : a formal deliberative assembly of princes or estates **2** : any of various national or provincial legislatures

[1]di-etary \'dī-ə-ˌter-ē\ *n, pl* **di-etar-ies** (15c) : the kinds and amounts of food available to or eaten by an individual, group, or population

[2]dietary *adj* (1614) : of or relating to a diet or to the rules of a diet — **di-etari-ly** \ˌdī-ə-'ter-ə-lē\ *adv*

dietary law *n* (ca. 1930) : one of the laws observed by Orthodox Jews that permit or prohibit certain foods

di-etet-ic \ˌdī-ə-'tet-ik\ *adj* (1579) **1** : of or relating to diet **2** : adapted for use in special diets — **di-etet-i-cal-ly** \-i-k(ə-)lē\ *adv*

di-etet-ics \-'tet-iks\ *n pl but sing or pl in constr* (1541) : the science or art of applying the principles of nutrition to the diet

di-ether \(ˌ)dī-'ē-thər\ *n* (1950) : a chemical containing two atoms of oxygen with ether linkages

di-eth-yl-car-bam-azine \ˌdī-ˌeth-əl-kär-'bam-ə-ˌzēn, -zən\ *n* [*di-* + *ethyl* + *carboxy-* + *amide* + *azine*] (1968) : an anthelmintic administered in the form of its crystalline citrate $C_{10}H_{21}N_3O{\cdot}C_6H_8O_7$ esp. to control filariasis in man and large roundworms in dogs and cats

di-eth-yl ether \(ˌ)dī-ˌeth-əl-\ *n* (ca. 1930) : ETHER 3a

di-eth-yl-stil-bes-trol \-stil-'bes-ˌtrōl, -ˌtrōl\ *n* [ISV] (1938) : a colorless crystalline synthetic compound $C_{18}H_{20}O_2$ used as a potent estrogen — called also *stilbestrol*

di-eti-tian *or* **di-eti-cian** \ˌdī-ə-'tish-ən\ *n* [*dietitian* irreg. fr. [1]*diet*] (ca. 1846) : a specialist in dietetics

dif-fer \'dif-ər\ *vi* **dif-fered; dif-fer-ing** \-(ə-)riŋ\ [ME *differen*, fr. MF or L; MF *differer* to postpone, be different, fr. L *differre*, fr. *dis-* + *ferre* to carry — more at BEAR] (14c) **1 a** : to be unlike or distinct in nature, form, or characteristics ⟨the law of one state ~s from that of another⟩ **b** : to change from time to time or from one instance to another : VARY **2** : to be of unlike or opposite opinion : DISAGREE ⟨they ~ on religious matters⟩

[1]dif-fer-ence \'dif-ərn(t)s, 'dif-(ə-)rən(t)s\ *n* (14c) **1 a** : the quality or state of being different **b** : an instance of differing in nature, form, or quality **c** *archaic* : a characteristic that distinguishes one from another or from the average **d** : the element or factor that separates or distinguishes contrasting situations **2** : distinction or discrimination in preference **3 a** : disagreement in opinion : DISSENSION **b** : an instance or cause of disagreement **4** : the degree or amount by which things differ in quantity or measure; *specif* : REMAINDER 2b(1) **5** : a significant change in or effect on a situation

[2]difference *vt* **-enced; -enc-ing** (15c) : DIFFERENTIATE, DISTINGUISH

dif-fer-ent \'dif-ərnt, 'dif-(ə-)rənt\ *adj* [MF, fr. L *different-, differens*, prp. of *differre*] (14c) **1** : partly or totally unlike in nature, form, or quality : DISSIMILAR ⟨could hardly be more ~⟩ — often followed by *from, than,* or chiefly Brit. *to* ⟨small, neat hand, very ~ from the captain's tottery characters —R. L. Stevenson⟩ ⟨vastly ~ in size than it was twenty-five years ago —N. M. Pusey⟩ ⟨a very ~ situation to the . . . one under which we live —Sir Winston Churchill⟩ **2** : not the same: as **a** : DISTINCT ⟨~ age groups⟩ **b** : VARIOUS ⟨~ members of the class⟩ **c** : ANOTHER ⟨did not like the TV program so switched to a ~ channel⟩ **3** : UNUSUAL, SPECIAL ⟨she was ~ and superior⟩ — **dif-fer-ent-ness** *n*

syn DIFFERENT, DIVERSE, DIVERGENT, DISPARATE, VARIOUS mean unlike in kind or character. DIFFERENT may imply little more than separateness but it may also imply contrast or contrariness ⟨*different* foods⟩ DIVERSE implies both distinctness and marked contrast ⟨such *diverse* interests as dancing and football⟩ DIVERGENT implies movement away from each other and unlikelihood of ultimate meeting or reconciliation ⟨went on to pursue two very *divergent* careers⟩ DISPARATE emphasizes incongruity or incompatibility ⟨*disparate* notions of freedom⟩ VARIOUS stresses the number of sorts or kinds ⟨*various* methods have been tried⟩

usage Numerous commentators have condemned *different than* in spite of its use since the 17th century by many of the best-known names in English literature. It is nevertheless standard and is even recommended in some of the handbooks when followed by a clause. *Different from,* the generally recommended safe choice, is more common and is even used in constructions where *than* would work more smoothly.

dif-fer-en-tia \ˌdif-ə-'ren-ch(ē-)ə\ *n, pl* **-ti-ae** \-chē-ˌē, -chē-ˌī\ [L, difference, fr. *different-, differens*] (1690) : the element, feature, or factor that distinguishes one entity, state, or class from another; *esp* : a characteristic trait distinguishing a species from other species of the same genus

[1]dif-fer-en-tial \ˌdif-ə-'ren-chəl\ *adj* (1647) **1 a** : of, relating to, or constituting a difference : DISTINGUISHING **b** : making a distinction between individuals or classes **c** : based on or resulting from a differential **d** : functioning or proceeding differently or at a different rate **2** : being, relating to, or involving a differential or differentiation **3 a** : relating to quantitative differences **b** : producing effects by reason of quantitative differences — **dif-fer-en-tial-ly** \-'ren-ch(ə-)lē\ *adv*

[2]differential *n* (1704) **1 a** : the product of the derivative of a function of one variable by the increment of the independent variable **b** : a sum of products in which each product consists of a partial derivative of a given function of several variables multiplied by the corresponding increment and which contains as many products as there are independent variables in the function **2** : a difference between comparable individuals or classes ⟨the price ~ between nationally advertised and private brands of staple food items); *also* : the amount of such a difference ⟨the ~ between regular and high-test gasoline may exceed five cents a gallon⟩ **3 a** : DIFFERENTIAL GEAR **b** : a case covering a differential gear

differential calculus *n* (1702) : a branch of mathematics concerned chiefly with the study of the rate of change of functions with respect to their variables esp. through the use of derivatives and differentials

differential equation *n* (1763) : an equation containing differentials or derivatives of functions

differential gear *n* (ca. 1864) : an arrangement of gears forming an epicyclic train for connecting two shafts or axles in the same line, dividing the driving force equally between them, and permitting one shaft to revolve faster than the other — called also *differential gearing*

dif-fer-en-ti-ate \ˌdif-ə-'ren-chē-ˌāt\ *vb* **-at-ed; -at-ing** *vt* (1816) **1** : to obtain the mathematical derivative of **2** : to mark or show a difference in : constitute a difference that distinguishes **3** : to develop differential characteristics in **4** : to cause differentiation of in the course of development **5** : to express the specific distinguishing quality of : DISCRIMINATE ~ *vi* **1** : to recognize or give expression to a difference **2** : to become distinct or different in character **3** : to undergo differentiation — **dif-fer-en-tia-bil-i-ty** \-ˌren-ch(ē-)ə-'bil-ət-ē\ *n* — **dif-fer-en-tia-ble** \-'ren-ch(ē-)ə-bəl\ *adj*

dif-fer-en-ti-a-tion \-ˌren-chē-'ā-shən\ *n* (1855) **1** : the act or process of differentiating **2** : development from the one to the many, the simple to the complex, or the homogeneous to the heterogeneous **3 a** : modification of body parts for performance of particular functions **b** : the sum of the processes whereby apparently indifferent cells, tissues, and structures attain their adult form and function **4** : the processes by which various rock types are produced from a common magma

dif-fer-ent-ly \'dif-ərnt-lē, 'dif-(ə-)rənt-\ *adv* (14c) **1** : in a different manner **2** : OTHERWISE

dif-fi-cile \'dē-fi-'sē(ə)l\ *adj* [F, lit., difficult] (1536) : STUBBORN, UNREASONABLE

dif-fi-cult \'dif-i-(ˌ)kəlt\ *adj* [back-formation fr. *difficulty*] (15c) **1** : hard to do, make, or carry out : ARDUOUS ⟨a ~ climb⟩ **2 a** : hard to deal with, manage, or overcome ⟨a ~ child⟩ **b** : hard to understand : PUZZLING ⟨~ reading⟩ *syn* see HARD — **dif-fi-cult-ly** *adv*

dif-fi-cul-ty \-kəl-tē, -kəl-\ *n, pl* **-ties** [ME *difficulte*, fr. L *difficultas*, irreg. fr. *difficilis*] (14c) **1** : the quality or state of being difficult **2** : CONTROVERSY, DISAGREEMENT **3** : OBJECTION **4** : something difficult : IMPEDIMENT **5** : EMBARRASSMENT, TROUBLE — usu. used in pl.

dif-fi-dence \'dif-əd-ən(t)s, -ə-ˌden(t)s\ *n* (15c) : the quality or state of being diffident

dif-fi-dent \-əd-ənt, -ə-ˌdent\ *adj* [L *diffident-, diffidens*, prp. of *diffidere* to distrust, fr. *dis-* + *fidere* to trust — more at BIDE] (15c) **1** : hesitant in acting or speaking through lack of self-confidence **2** *archaic* : DISTRUSTFUL **3** : RESERVED, UNASSERTIVE *syn* see SHY — **dif-fi-dent-ly** *adv*

dif-fract \dif-'rakt\ *vt* [back-formation fr. *diffraction*] (1803) : to cause to undergo diffraction

dif-frac-tion \dif-'rak-shən\ *n* [NL *diffraction-, diffractio*, fr. L *diffractus*, pp. of *diffringere* to break apart, fr. *dis-* + *frangere* to break — more at BREAK] (1673) : a modification which light undergoes in passing by the edges of opaque bodies or through narrow slits or in being reflected from ruled surfaces and in which the rays appear to be deflected and to produce fringes of parallel light and dark or colored bands; *also* : a similar modification of other waves (as sound waves)

diffraction grating *n* (1867) : GRATING 3

[1]dif-fuse \dif-'yüs\ *adj* [L *diffusus*, pp. of *diffundere* to spread out, fr. *dis-* + *fundere* to pour — more at FOUND] (15c) **1** : being at once verbose and ill-organized **2** : not concentrated or localized : SCATTERED ⟨~ sclerosis⟩ *syn* see WORDY — **dif-fuse-ly** *adv* — **dif-fuse-ness** *n*

[2]dif-fuse \dif-'yüz\ *vb* **dif-fused; dif-fus-ing** [ME or L; MF *diffuser*, fr. L *diffusus*, pp.] *vt* (15c) **1 a** : to pour out and permit or cause to spread freely **b** : EXTEND, SCATTER **c** : to spread thinly or wastefully **2** : to subject to diffusion; *esp* : to break up and distribute (incident light) by reflection ~ *vi* **1** : to spread out or become transmitted esp. by contact **2** : to undergo diffusion

dif-fuse-po-rous \dif-ˌyüs-'pōr-əs, -'pór-\ *adj* [*diffuse*] (ca. 1902) : having vessels more or less evenly distributed throughout an annual ring and not varying greatly in size — compare RING-POROUS

dif-fus-er \dif-'yü-zər\ *n* (1679) **1** : one that diffuses: as **a** : a device (as a reflector) for distributing the light of a lamp evenly **b** : a screen (as of cloth or frosted glass) for softening lighting (as in photography) **c** : a device (as slats at different angles) for deflecting air from an outlet in various directions **2** : a device for reducing the velocity and increasing the static pressure of a fluid passing through a system

dif-fus-ible \dif-'yü-zə-bəl\ *adj* (1782) : capable of diffusing or of being diffused